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Predictors Of Fruit And Vegetable Intake Among University Students

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PREDICTORS OF FRUIT AND VEGETABLE INTAKE AMONG UNIVERSITY STUDENTS

by

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This thesis, submitted by Ashley Citrowske in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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Title Predictors of Fruit and Vegetable Intake Among University Students

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Ashley Citrowske

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To my husband, Cedric,
For his patience and steady support

ABSTRACT

Students' food preferences may change and develop while attending college. These changes could have an impact on their nutritional health during enrollment and after graduation and, as an extension, their disease risk and overall health. College students living on or near a campus are a convenient population to provide health and nutrition education. A cross-sectional, secondary analysis was completed on NCHA-ACHA health survey data from one public, Midwestern university. Survey questions relating to dietary behaviors were included in this secondary data analysis. Females were more likely to report higher intake of fruits and vegetables compared with males. Fruit and vegetable intake varied by perceived health in college students. No significant relationship was found between year in school, age, or living situation and reported fruit and vegetable intake. This study adds to the body of research regarding the dietary behaviors of college students. Future research could elaborate on the relationship of fruit and vegetable intake and health perception.

Chapter 1: Introduction

The role of nutrition in overall health is well established. Decisions made regarding food and beverage intake during each portion of the life cycle have both immediate and long-term health outcomes. Specifically, nutrition choices during the traditional college years, including late adolescence and early adulthood, have been linked to cardiovascular health later in life. For example, adequate intake of fruits and vegetables during college years was associated with decreased risk of cardiovascular events decades later (Liu et al., 2012). There is also evidence to support more immediate impacts of nutrition, such as alcohol intake and food insecurity, on the lives of university students including attendance, grade point average (GPA), and test grades. Intake of fruits and vegetables has been linked with academic success while higher consumption of French fries and high calorie beverages was associated with increased likelihood of skipping exams (Burrows et al., 2017; Deliens et al., 2013).

College students develop lifestyle habits that will impact their health over the course of their lifetime (Liu et al., 2012). Stress, diet, and sleep have all been associated overall health and wellbeing. During their time at a university, students often experience stress, inconsistent sleep, and undesirable dietary choices. For this reason, among others, many universities have implemented programs to promote health and wellness on their campuses. Health promotion staff include dietitians or nutritionists, public health professionals, exercise experts and others who are positioned at a facility with a focus on improving the health of the students. Building a body of research that clearly describes the problem and identifies relationships between characters and behaviors can aid in the development of programs that successfully facilitate improved health and wellbeing during college and as this population ages.

The transition through college is an opportune time to provide health education and direction, as such, health promotion is an increasingly common feature on college campuses. Programs and facilities designed to support students in areas other than academics, including nutrition and physical activity, are now components at universities around the world. Since nutrition has both immediate and delayed impacts on academics and health during college, it is an important opportunity to provide education on balanced nutrition (Burrows et al., 2017; Deliens et al., 2013; Liu et al., 2012). Although "college students" is a broad group and encompasses many demographics, they remain a population that is an easier target for education and health promotion due to their congregation on campuses and commonalities in what may influence their food related behaviors.

College campuses bring together students from varying economic and cultural backgrounds from around the world. Within this diversity, there are similarities for which factors students feel are motivating their food related choices. Food characteristics, peer acceptance, and other environmental factors are all a part of what students identify as important to them when they choose their foods (Boek et al., 2012; Despande et al., 2009; Brunstrom et al., 2008). Although there are overarching influences, there are also factors that affect the importance level of certain determinants such as gender, status in school, and living situation (Deshpande et al., 2009; Small et al., 2013; Vilaro et al., 2018). The literature outlining potential influences for food choice among college students is not limited, but there is a lack of research on whether these influencing factors or determinants are predictive of intake.

While it is unlikely that health promotors will be able to change whether a person prefers certain tastes, they may be able to provide guidance on preparation methods and encourage

introduction of new flavors. Health promotors can frame their education and resources to best integrate and utilize the most suited influencing factors for each situation. Based on the available research, if a goal of a health promotor is to increase dairy intake amongst students, showing that peers are choosing dairy could be an impactful method (Larson et al., 2009). Similarly, educating on reduced cost methods for preparation of fruit and vegetables could be effective for a demographically diverse health promotion campaign on a college campus (Boek et al., 2012).

A more inclusive base of knowledge regarding food related choices students are making and how these choices are impacting their health, perceptions, and academic success would provide universities and health promotors with critical information for program development. While there is a wide variety of information on what influences food behaviors, there is limited published research on using these influencing factors in health promotion development to incite behavior change. Additionally, determining whether factors that students traditionally cite as influences relate to differences in reported behaviors. The purpose of this study is to evaluate whether there are factors to predict students' reported intake of fruits and vegetable.

The hypotheses tested are as follows:

H_0 Reported intake of fruit and vegetables is not predicted by other factors.

H_1 Gender predicts fruit and vegetable intake.

H_2 Higher perceived health is correlated with higher fruit and vegetable intake.

H_3 Living on or off campus predicts fruit and vegetable intake.

H_4 Living with parents or a guardian predicts fruit and vegetable intake.

H_5 Age predicts fruit and vegetable intake.

H_6 Year in school predicts fruit and vegetable intake.

Chapter 2: A Review of the Literature

Obtaining an undergraduate degree has long been associated with also obtaining undesirable weight gain and poor food choices. The "Freshman 15," while largely exaggerated from the actual average weight gain of one to five pounds, does provide some insight into the perceived dietary and activity level changes associated with starting college (Baum, 2017). Limited access to cooking facilities, as is often the case with dormitory style living, decreases the autonomy allowed in cooking for oneself and having control over what foods are available at any given time. To cater to the wide variety of expectations students have for food and beverages, university dining facilities usually offer a wide array of dining options (Klassen et al., 2005). While access to an assortment of foods can encourage students to learn to make choices that support their body's needs, it may also remove barriers to food cravings and intake of energy-dense but nutrient lacking foods (Burrows et al., 2017).

There are many factors that contribute to the dietary intake of college students, including, but not limited to, cost, taste, convenience, living situation, social and cultural influences, and health considerations. Demographics can also be a determining factor of what influences choices. It is important that this is accounted for when developing health promotion materials and programming. With evidence to support room for improvement in the dietary intake and health habits of students, health promotion is an increasing feature on college campuses (American College Health Association, 2018). It has been determined that young adulthood and time spent on a college campus are critical times for providing nutrition education (Pember & Knowlden, 2017).

Aiming to improve the overall wellness of the campus community, these programs are designed to provide education and resources on many facets of health, including nutrition. Since it has been determined that most college students are not meeting the recommended intake of fruits, vegetables, and dairy, these areas may be a focus for intervention through health promotion (Larson et al., 2009; American College Health Association, 2018). When addressing this divergence between recommendations and actions, it is important to understand what factors are influencing students to make the food choices that they do. This review will focus on what is known regarding dietary intake and behaviors of college students, the factors that influence their food choices, and how nutrition impacts health and perceptions of health in this population.

General Nutrition in College

Conventional wisdom claims that nutrition during college is not reflective of a healthy diet. It is generally assumed that college students do not consume enough fruits and vegetables, rely heavily on convenience foods, and drink more than the recommended amount of alcohol. Unfortunately, available research on general nutrition in college supports some of these assumptions (World Health Organization, 2003; American College Health Association, 2018).

According to the American College Health Association - National College Health Assessment (ACHA-NCHA) from 2018, more than 95% of college students surveyed reported eating less than five servings of fruits and vegetables per day and 8.4% of participants reported eating no servings of these foods on a daily basis. This is in stark contrast to the World Health Organization (WHO) and Dietary Guidelines for Americans which both encourage intake of greater than five servings of fruits and vegetables per day for adults. According to the WHO (2003), increased fruit and vegetable intake around the world could save as many as 2.7 million

lives due to known health benefits of these foods such as reduced risk of ischemic heart disease, stroke, and certain types of cancers. While the importance of fruit and vegetable intake is not widely disputed, there are barriers and other factors that can inhibit adequate intake.

Moving out of the parental home can open the doors to new challenges or opportunities in a young adult's life. Often, there is a change in financial abilities and availability of cooking facilities leading to a shift in perceived food option availability. Foods that were previously readily available now need to be planned for and purchased prior to consumption. In one study, students who lived with their parents reported higher intakes of fruits and vegetables than those that lived on campus (Amuta et al., 2016). In addition, moving from living on campus to living independently off campus is also associated with a decrease in fruit and vegetable intake (Small et al., 2013). Environmental changes may limit access to fruits and vegetables and therefore predict reduced dietary intake of these foods among college students.

Although these shifts in intake may be disregarded as temporary or a "rite of passage," it should be noted that intake during college has immediate impacts on academic success. A recent review by Burrows et al. (2017) found that diet and academic success were positively associated. The review highlighted breakfast intake, regular frequency of meals, and higher levels of fruit intake with better GPAs (Burrows et al., 2017). Although additional research is needed to confirm these findings, dietary intake may predict academic success and demand further attention.

The assumptions of the public regarding dietary behaviors of college students do not go unfounded within the available research. Negative outcomes such as decreased test scores and GPA along with reduced attendance, have been associated with the recorded dietary behaviors of

students (Burrows et al., 2017). There are numerous factors that could be used to modify dietary patterns or behaviors. These influencing factors will be outlined in the following section. If these influencing factors can be well understood, it is possible that college campuses could alter their environment or health promotion activities to encourage improved diet and overall health. Additionally, it may be prudent for researchers to measure these activities and programs in relation to academic measures of success to determine whether a beneficial relationship exists in this population.

Influencing Factors

Students attending college are a diverse population with many demographic considerations. In spite of this, there are underlying patterns of factors that influence the food choices that they make. Many of these factors are similar to the general adult population, but it is important to keep in mind that factors in a college setting may be more easily adjusted than in other settings later in life (Boek et al., 2012). Cost, taste, and level of convenience influence the college population's food choices (Boek et al., 2012; Deshpande et al., 2009). A summary of influencing factors and associated studies can be found in Table 1.

Food characteristics are some of the most cited influencing factors for food preferences (Boek et al., 2012; Deshpande et al., 2009). Food characteristics include taste, appearance, nutrition values, and cost. When making food choices, students prioritize which foods to choose using unique factors, but there are also similarities that influence college student's intake. Among college students, taste is the most common reason for liking or disliking a food (Boek et al., 2012; Deshpande et al., 2009). Cost is another influence for whether a student chooses a food (Boek et al, 2012). Although not a surprising point of influence, income can be a limiting factor

for which food choices are viable for a student focusing on their studies. Boek et al. (2012) found that a majority of students identified increased cost as a reason for avoiding fresh fruits and vegetables while their perceived lower cost led to increased intake of convenience meals. Students' food choices were more consistently influenced by a food being identified as poor quality than a food being identified as high quality. Thus, a student to choose to eat or decline to eat a food more often because it was poor quality than high quality. Quality of food and perceived nutrition benefits were both indicated as having a significant influence on intake (Boek et al., 2012). Characteristics of a food item are the most consistent predictor in whether a person believes they would choose it, but there are other factors that can sway intake related decisions.

Convenience plays a large role in college student's intake choices (Boek et al., 2012; Deshpande et al., 2009; Larson et al., 2009). Perceived barriers to access can make it seem inconvenient or even difficult to acquire, prepare, or consume foods. If students feel there is low access to healthy options, such as fruits and vegetables, they are less likely to seek them out (Dhillon et al., 2019). Other potential barriers that influence food choices are distance from food purchasing locations, limited time to prepare or purchase foods, budget, and low self-efficacy (Deshpande et al., 2009). Highlighting strategies to overcome barriers and the benefits of a balanced diet may be helpful in aiding students' in overcoming perceived barriers and achieve better nutritional health. The factors discussed to this point are primarily extrinsic factors that can be more easily manipulated by health promotors and college dining facilities. Intrinsic factors such as health knowledge and emotions also dictate food behaviors and are perceived as less easily manipulated by health promotors.

Students' knowledge about health predicts dietary choices. Health literacy and health knowledge differ in that health literacy is the ability to read or take in health information and understand it, while health knowledge involves being able to recall the information without a prompt (Hansen et al., 2015). While there are instances the two terms are used interchangeably, they have different levels of impact on food choices for college students. Nutrition related health knowledge is predictive of decreased saturated fat, trans-fat, and cholesterol intake (Yahia et al., 2016). In contrast, health literacy on its own, although it may impact ability to increase nutrition knowledge, is not directly associated with any impact on food intake habits (Hansen et al., 2015). Thus, both health knowledge and literacy are important characteristics to consider when developing nutrition education programs for college students.

Food characteristics, perceptions, and health education were the most discussed influencing factors for dietary choices among the studies, but others reported factors include emotion, dieting status, and peer support. Emotion as an influence on foods choice was only cited in one study included in the review. In the study by Ashurst et al. (2018), 663 first-year college students were randomly surveyed four times throughout a seven-day period and asked about their eating habits and the mood they were in. It was found that both positive and negative emotions were influencing factors for foods choices and portion sizes, particularly protein and meats, sweets, and fast food or pizza (Ashurst et al., 2018). Portion sizes were also influenced by whether a person reported being on a diet, but not by body mass index (BMI) (Brunstrom et al., 2008). Limited research is available for the college population examining the role of emotion in food choices.

Environmental and social cues can also influence food choices. Cues such as a doctor recommending a diet, seeing a diet on mass media, or having foods recommended by friends or family are all influencers on a student's food choices (Deshpande et al., 2009). Perceived acceptance of peers was found to be a positive influencing factor for dairy intake, this factor was not included in other studies for this review (Larson et al., 2009). In addition to social cues, dining location and design also changes the perceived likelihood of eating certain foods. Students reported being more likely to prefer eating food prepared at a smaller setting where food is made from scratch rather than at a large dining facility, even if both are on campus (Boek et al., 2012).

Table 1: Influencing Factors for Food Choices of College Students

Influencing Factor	Studies
Food Characteristics	Boek et al., 2012; Deshpande et al., 2009
Convenience	Boek et al., 2012; Deshpande et al., 2009; Larson et al., 2009; Dhillon et al., 2019
Health Perception	Deshpande et al., 2009
Health Literacy or Health Knowledge	Hansen et al., 2015; Yahia et al., 2016
Emotion	Ashurst et al., 2018
Peer Acceptance	Larson et al., 2009
Other Environmental Factors	Brunstrom et al., 2008; Deshpande et al., 2009; Boek et al., 2012

As previously summarized, there are influencing factors on food intake for university students are true across demographics. It is also prudent to note that there are many factors that are unique or have more weight within certain parts of this population. Health promotion and education can and should be adjusted to serve each demographic group and address concerns that

are important to all students. Demographic considerations such as gender, race, and living situation can modify the level of importance that each influencing factor has for a student. Taking these demographic determinants of influence into account with the demographics of the university itself can lead to more effective health promotion interventions (Pember & Knowlden, 2017).

Determinants of Influence

Influencing factors can be more easily manipulated by the university while determinants of influences are less modifiable by an institution. A summary of determinants and associated studies can be found in Table 2. In multiple studies, gender was identified as a determinant for food choices. Although both males and females indicate that taste is the most important influencing factor for food choices, there are differences in how important other influencing factors are (Deshpande et al., 2009; Boek et al., 2012; Amuta et al., 2016). Males generally consume more fat, fiber, and more fruits and vegetables, but are less likely than females to report healthful eating habits such as having breakfast and reading food labels (Li et al., 2012).

Males are more likely to cite cost, inconvenience, and taste as reasons for avoiding foods whereas females cite nutritional value as an influencing factor (Boek et al., 2012). Females report avoidance of meat due to concern for their health and weight and are more likely than males to seek out low-fat food choices (Boek et al., 2012). Females are also more likely to report that perceived barriers would prevent them from making healthful choices (Desphpande et al., 2009). Among students whose BMI are above 25.0, females are more likely to take into account health impacts of a food than their male counterparts (Amuta et al., 2016). Regardless of gender,

the transition into college is a time of significant changes that may include leaving the parental home and establishing a new lifestyle with the influence of the campus and peers.

There is evidence to support a change in influencing factors as a student progresses through their years at a university although there was not a significant difference in food behaviors between upper- and lower-classman (Driskell et al., 2005; Vilaro et al. 2018). Although the targeted behaviors remain the same, such as increasing fruit and vegetable intake, the methods that will work to change these behaviors may differ. Over the first year in college, priorities regarding food choices can change (Vilaro et al., 2018). A study by Vilaro et al. (2018) found that at the beginning of freshman year, price, busy life, food preference, family influence, and health aesthetics were cited as the most important influencing factors for food choice. By the end of freshman year, most of these remained and stress became significantly important while family became less of an influence (Vilaro et al., 2018).

Less studied determinates for food choice include race and ethnicity. Boek et al. (2012) found that White students were less likely to consider inconvenience an influencing factor than students of other races or ethnicities. White students were also more likely to site poor nutrition as an influencing factor for food dislikes, while other races and ethnicities cited poor taste, high cost, and low quality (Boek et al, 2012).

Most influencing factors for college student's food choices are similar across demographics although they may carry different weight. With consideration to the available research, it is best to approach health promotion in varying ways based on demographic distribution on the campus. This is especially true of differences in values between males and females. Limited research also supports some differences present between races and ethnic

groups for influencing factors in this age group, but more data is needed using demographics consistent with that of the universities being studied.

Table 2: Determinants for Food Choices of College Students

Determinant	Studies
Gender	Deshpande et al., 2009; Boek et al., 2012; Li et al., 2012
Status in School	Driskell et al., 2005; Vilaro et al. 2018
Race and Ethnicity	Boek et al., 2012
Body Mass Index	Amuta et al., 2016
Living Situation	Small et al., 2013; Amuta et al., 2016

Summary

College is a time of transition. There are both internal and external factors that change as a student moves through college which could result in a change in overall diet and health-related behaviors. Upon leaving the parental home, intake of fruits and vegetables generally decreases and is replaced with items perceived as more convenient. Reduced intake of fruits and vegetables is associated with lower GPAs and replacement of those foods with less nutrient dense options is associated with reduced attendance and lower test scores. Due to this unfortunate correlation, it is important to identify ways in which the dietary behaviors of this subset of the adult population improved upon. The literature available outlines the factors that students perceive as important influences for their diet. However, there is less research on whether demographic factors predict intake of food choices. In other words, whether the factors found to be determinants of influence

translate into reported behaviors. The following study evaluates a number of these factors and determine any relationship with reported intake of fruits and vegetables.

Chapter 3: Methods

Apparatus

The American College Health Association (ACHA) released the first National College Health Assessment (NCHA I) in 2000 and revised it to the NCHA II in 2008 (American College Health Association, 2013). The survey is administered every two years by universities around the United States to randomly selected samples of their student bodies. Each university has the opportunity to add questions of their own to the standard survey. The survey is intended to collect information on a wide variety of health information including physical, mental, and emotional health along with various outcomes such as GPA and perceived level of health. Survey respondents may be attending a participating university at any education level and enrollment status.

The ACHA-NCHA II survey results are comprised of aggregate data and are collected by a self-administered, electronic survey sent to a random sample of the student body at each participating university. The research protocol for the online survey at the university was approved by the Institutional Review Board (IRB-201312-188).

Analysis

The NCHA-ACHA II Spring 2018 data from a Midwestern University in the United States was analyzed utilizing SPSS 26 (IBM Corp., 2019). The survey results were used for a cross-sectional, secondary analysis. Dietary behavior data collected within the national survey was limited, although there was a question regarding frequency of fruit and vegetable intake. Questions included in the analysis focused on nutrition intake and health perceptions. Survey

participants rated their fruit and vegetable intake on an ordinal scale and their level of health from poor to excellent. Fruit and vegetable intake was evaluated as one component rather than as separate food groups by survey design. While the supplemental questions added by the university addressed nutrition habits more specifically, they were excluded from the analysis on the grounds that they were not validated. A complete list of survey questions and responses included in the analysis can be found in the Appendix.

For analysis, categories of fruit and vegetable intake were collapsed to include Low Intake (0-2 servings) or High Intake (three or more servings) per day. In addition, due to small category size, the status in school category of "other" was not included for assessment. Due to low reporting of both excellent and poor perceived health status, students were either categorized as having Positive or Non-Positive perceptions. Positive perceptions included those that reported their health as excellent, very good, and good. Non-Positive perceptions included fair or poor. Participants who responded "don't know" (n=1) to their perceived health status were excluded. Gender (male or female), age (in years), and living arrangement (on- or off-campus; living with or without parents or a guardian) were also included in the analysis. Since most of the data collected in the survey was categorical, chi-square tests were used for most of the analyses. For comparing age and fruit and vegetable intake an independent samples t-test was utilized. For all analyses, the level of significance was set at p=0.05.

Participants

For the 2017-2018 school year in which this survey took place, the university whose data was utilized for this analysis reported a total student body of 14,406 with 48% (n=6,962) identifying as female and 52% (n=7,443) male. Freshmen made up 18.1% (n= 2,608) of the

student body (University of North Dakota, 2018). It should be noted that the university reported by levels of study (i.e. Freshman, Sophomore, etc.) whereas the survey collected status based on number of years attended. Since students may be of Sophomore standing during their first year at the university due to credits earned during secondary school, it is justifiable that these numbers may not align.

Chapter 4: Results

This study evaluated fruit and vegetable intake among college students and the factors that are associated with differences in fruit and vegetable intake. There was a 14.1% response rate to the survey with a total of 842 respondents. All participants were 18 years or older and were undergraduate or graduate students attending the university either on-campus or distance at the time of data collection. For gender assigned at birth, 63.4% (n=526) of respondents were female. The race distribution of responses was similar to that of the university for that year with 90.7% White, 4.4% Asian, 3.7% Hispanic, 2.3% Black, 2.3% American Indian, 1.1% biracial or multiracial, and 1.1% other. First year students were overrepresented in the sample with 30.9% (n=257) of respondents identifying in this category. Demographic information of the respondents is outlined in Table 3.

Table 3: Demographics of Survey Respondents

	Undergraduate					Graduate/Professional (n=43)	Other (n=4)	Total (n=832)
	1st Year (n=257)	2nd Year (n=188)	3rd Year (n=164)	4th Year (n=125)	5th Year + (n=51)			
Average Age (SD)	18.7 (±1.183)	20.38 (±3.629)	21.63 (±3.682)	22.10 (±3.763)	24.53 (±3.426)	28.30 (±7.196)	23.25 (±3.096)	21.04 (±4.131)
Gender								
Female	69.3% (n=178)	63.4% (n=118)	65% (n=106)	59.2% (n=74)	35.3% (n=18)	69.8% (n=30)	50% (n=2)	63.4% (n=526)
Male	30.7% (n=79)	36.6% (n=68)	35% (n=57)	40.8% (n=51)	64.7% (n=33)	30.2% (n=13)	50% (n=2)	36.6% (n=303)
Race								
Asian	3.5% (n=9)	5.9% (n=11)	2.4% (n=4)	3.2% (n=4)	2.0% (n=1)	16.3% (n=7)	25% (n=1)	4.4% (n=37)
Black	1.9% (n=5)	2.7% (n=5)	0.6% (n=1)	2.4% (n=3)	0% (n=0)	9.3% (n=4)	0% (n=0)	2.3% (n=19)
Hispanic	3.9% (n=10)	5.3% (n=10)	1.8% (n=3)	1.6% (n=2)	5.9% (n=3)	7.0% (n=3)	0% (n=0)	3.7% (n=31)
Native American/American Indian	1.2% (n=3)	4.3% (n=8)	1.8% (n=3)	4.0% (n=5)	0% (n=0)	0% (n=0)	0% (n=0)	2.3% (n=19)
White	93.4% (n=240)	91.0% (n=171)	93.3% (n=153)	92.0% (n=115)	92.2% (n=47)	69.8% (n=30)	75.0% (n=3)	90.7% (n=764)
Biracial/Multiracial	0.4% (n=1)	2.1% (n=4)	1.2% (n=2)	0.8% (n=1)	2.0% (n=1)	0% (n=0)	0% (n=0)	1.1% (n=9)
Other	1.2% (n=3)	0.5% (n=1)	1.8% (n=3)	0% (n=0)	3.9% (n=2)	0% (n=0)	0% (n=0)	1.1% (n=9)
Living Arrangement								
Campus Residence Hall	89.1% (n=229)	31.4% (n=59)	13.4% (n=22)	3.2% (n=4)	7.8% (n=4)	4.7% (n=2)	50% (n=2)	38.7% (n=322)
Fraternity or sorority house	0% (n=0)	8.0% (n=15)	6.7% (n=11)	4.0% (n=5)	0% (n=0)	2.3% (n=1)	0% (n=0)	3.8% (n=32)
Other college/university housing	1.2% (n=3)	3.7% (n=7)	5.5% (n=9)	4.8% (n=6)	7.8% (n=4)	27.9% (n=12)	25.0% (n=1)	5.0% (n=42)
Parent/guardian's home	5.1% (n=13)	5.3% (n=94)	3.0% (n=5)	4.8% (n=6)	3.9% (n=2)	2.3% (n=1)	0% (n=0)	4.4% (n=37)
Other off-campus housing	4.3% (n=11)	50.0% (n=94)	70.7% (n=116)	82.4% (n=103)	80.4% (n=41)	60.5% (n=26)	0% (n=0)	47.0% (n=391)
Other	0.4% (n=1)	1.6% (n=3)	0.6% (n=1)	0.8% (n=1)	0% (n=0)	2.3% (n=1)	25% (n=1)	1.0% (n=8)
Enrollment Status								
Full-time	99.2% (n=255)	97.3% (n=183)	97.6% (n=160)	92.0% (n=115)	86.3% (n=44)	90.7% (n=39)	100% (n=4)	96.2% (n=800)
Part-time	0.8% (n=2)	2.7% (n=5)	1.8% (n=3)	8.0% (n=10)	13.7% (n=7)	9.3% (n=4)	0% (n=0)	3.7% (n=31)
Other	0% (n=0)	0% (n=0)	0.6% (n=1)	0% (n=0)	0% (n=0)	0% (n=0)	0% (n=0)	0.1% (n=1)
International Student								
No	97.7% (n=250)	96.3% (n= 181)	95.1% (n=155)	97.6% (n=122)	96.1% (49)	79.1% (n=34)	100% (n=4)	95.8% (n=795)
Yes	2.3% (n=6)	3.7% (n=7)	4.9% (n=8)	2.4% (n=3)	3.9% (n=2)	20.9% (n=9)	0% (n=0)	4.2% (n=35)

College students did not meet recommended intake for fruits and vegetables. The majority of participants (68.4%, n=573), reported eating less than half of the recommended five servings per day with the most frequent response for all participants being 1-2 servings of fruits and vegetables daily (60.6%). Only 4.1% of participants reported eating at least five servings of fruits and vegetables per day, while 7.8% of participants reported no daily fruit and vegetable intake. Reported fruit and vegetable intake for the study participants is available in Figure 1.

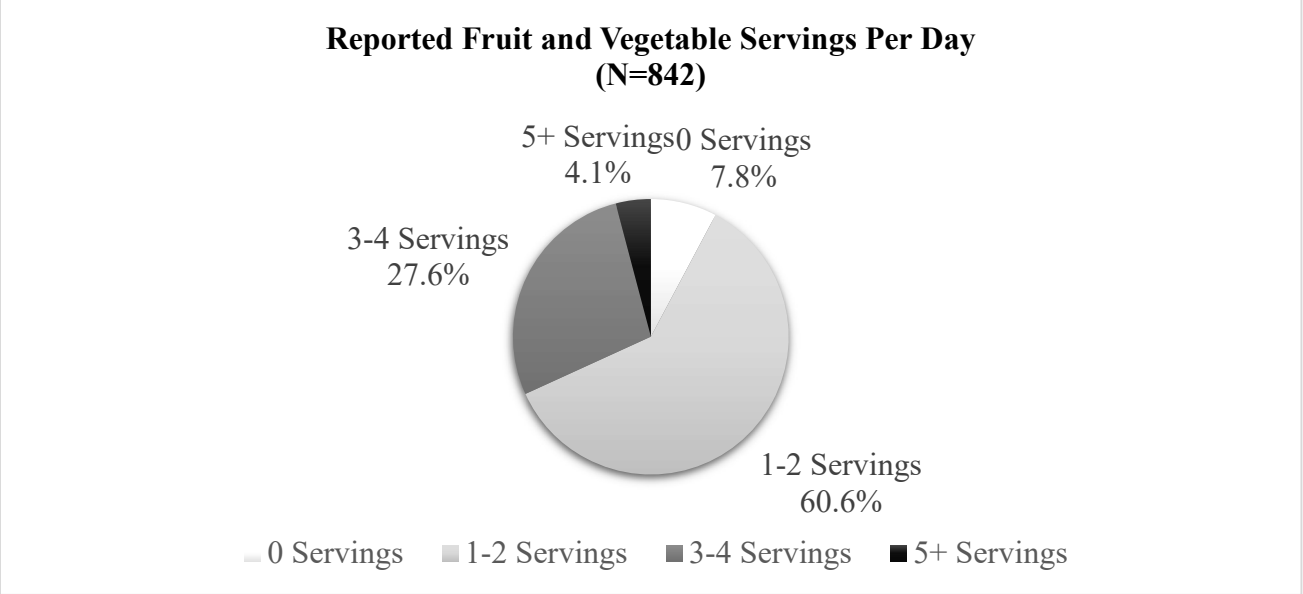

Figure 1: Reported Fruit and Vegetable Intake

Among potential demographic predictors, females were more likely to report higher intake of fruits and vegetables X^2 (1, N = 834) = 13.655, p<0.001 (See Figure 2). Thirty-six percent of females consumed at least three servings of fruits and vegetables daily, while 24% of males reported at least three servings of fruits and vegetables. No other demographic measures were related to reported fruit and vegetable intake.

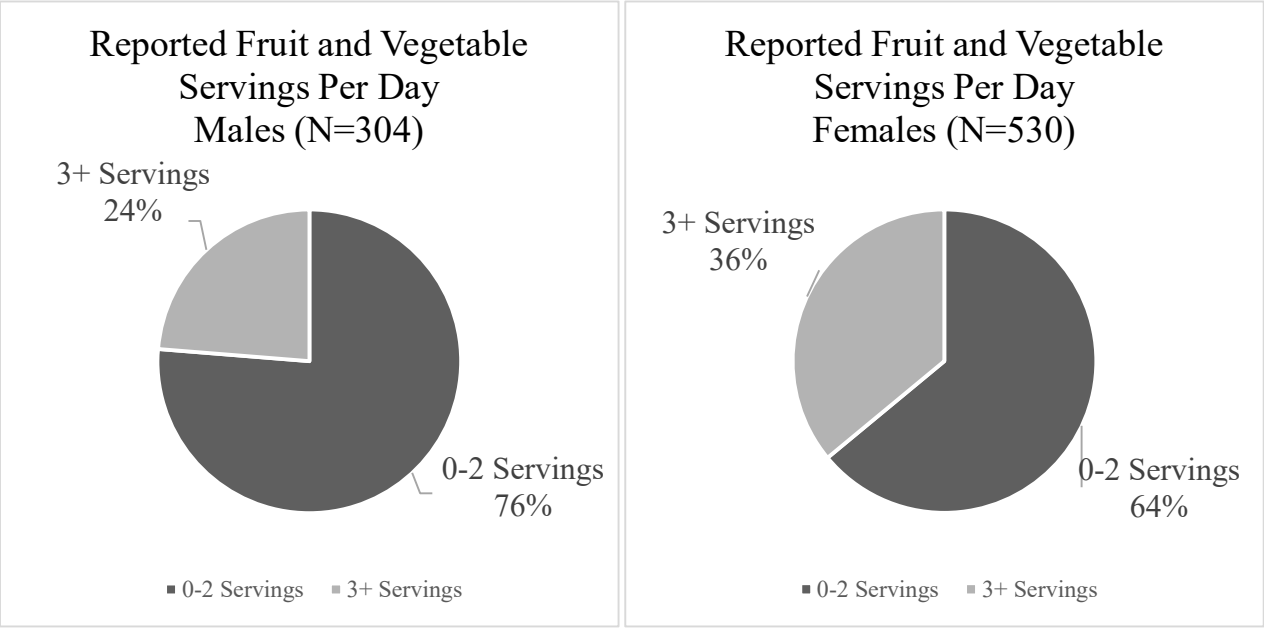

Figure 2: Fruit and Vegetable Intake by Gender

Participants who perceived themselves as having overall positive health were more likely to consume three or more servings of fruits and vegetables daily than their counterparts that perceived themselves to be of neutral or negative health status X^2 (1, N = 823) = 4.083, p=0.043 (See Figure 3). While the majority of participants (68.8%) reported two or fewer servings of fruits and vegetables per day independent of perceived health, 32.5% of participants with positive perceived health consumed at least three servings of fruits and vegetables, while only 22.5% of participants with non-positive perceived health reported eating at least three servings of fruits and vegetables daily.

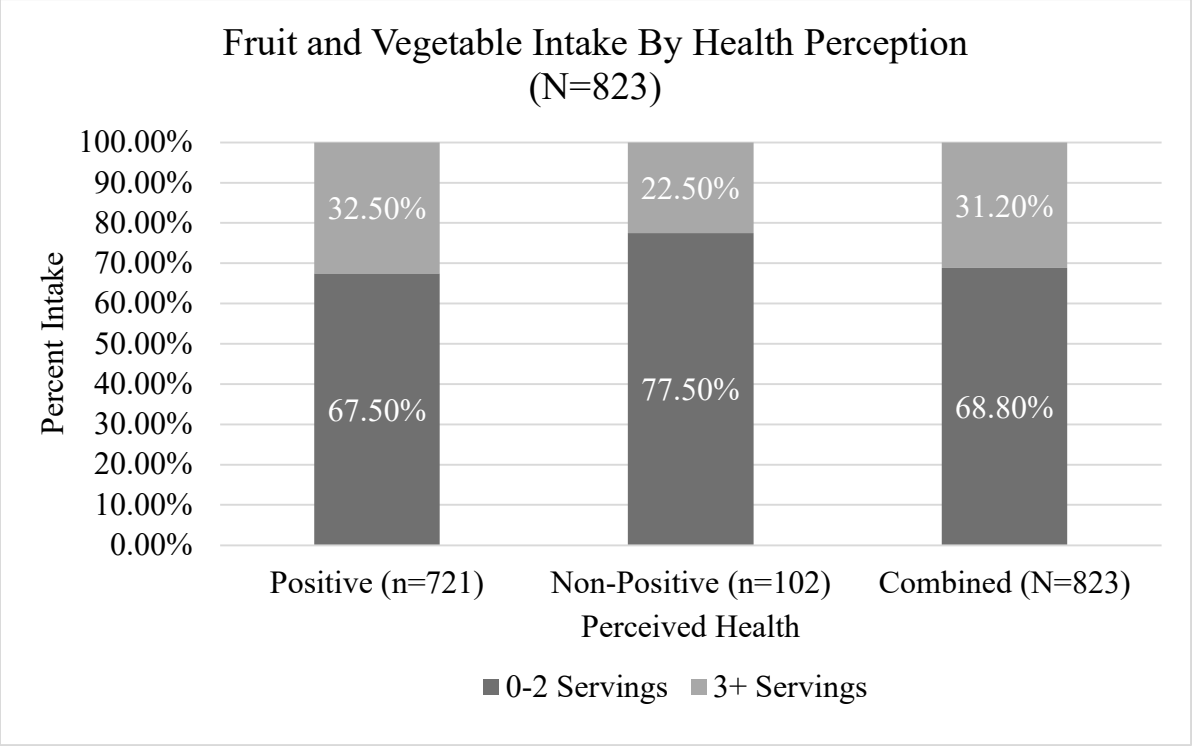

Figure 3: Reported Fruit and Vegetable Intake by Perceived Level of Health

Status in school X^2 (1, N = 785) = 0.002, p=0.965 (See Figure 4), age, t(833) = -0.695, p = 0.487, living situation X^2 (1, N =837) = 0.022, p=0.883, and living with or without parents or a guardian X^2 (1, N = 837) = 0.0001, p=0.991 did not predict fruit and vegetable intake.

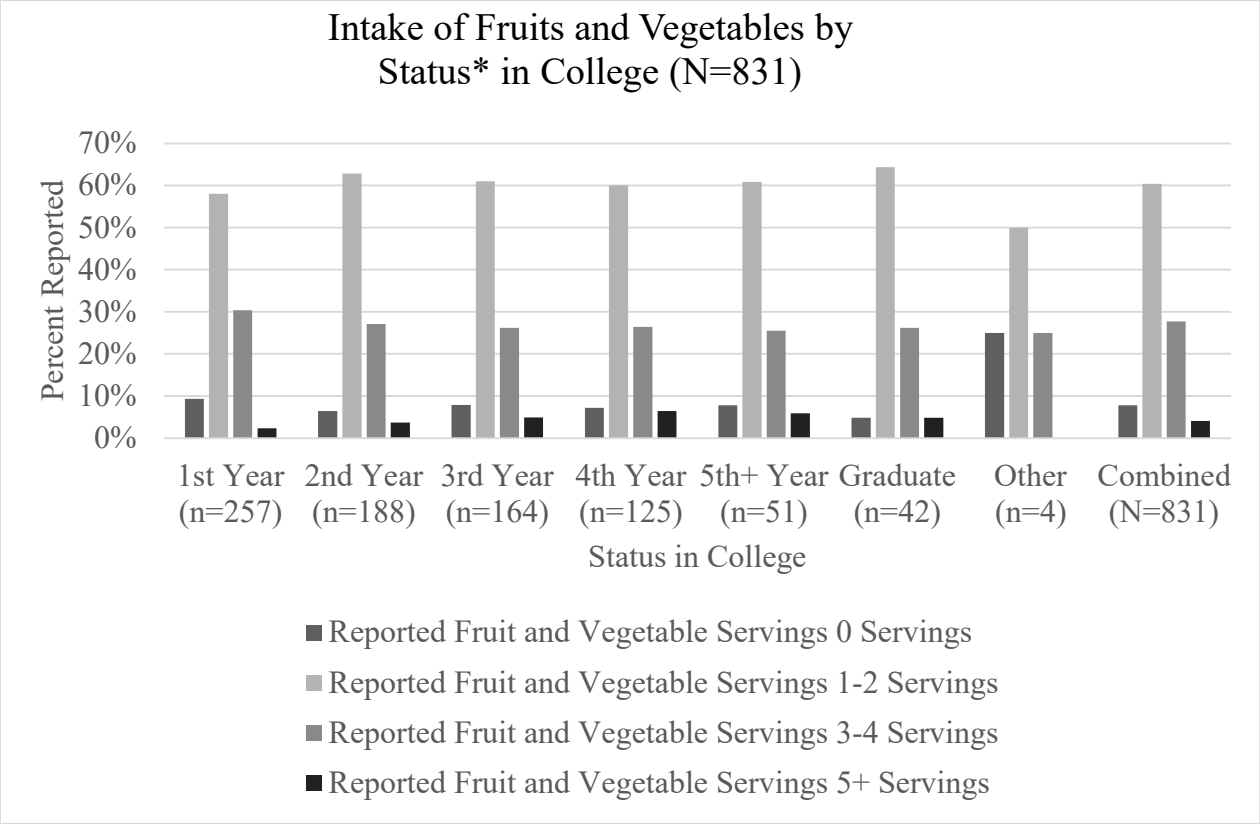

Figure 4: Fruit and Vegetable Intake by Status in College
*Status in college was defined by years spent at the university for undergraduate students.

This study tested the following hypotheses:

H_0 Reported intake of fruit and vegetables is not predicted by other factors.

H_1 Gender predicts fruit and vegetable intake.

H_2 Higher perceived health is correlated with higher fruit and vegetable intake.

H_3 Living on or off campus predicts fruit and vegetable intake.

H_4 Living with parents or a guardian predicts fruit and vegetable intake.

H_5 Age predicts fruit and vegetable intake.

H_6 Year in school predicts fruit and vegetable intake.

H_1, that gender predicts fruit and vegetable intake, was accepted, females were more likely to report consuming three or more servings of fruits and vegetables per day ($p<0.001$). H_2 was accepted if health perception is divided between positive and non-positive responses ($p<0.05$), but not if health perception is divided into positive, neutral, and negative responses. The remaining hypotheses were rejected in favor of the null hypothesis for the mentioned factors.

Chapter 5: Discussion

The purpose of this study was to identify predictors of fruit and vegetable intake among college students. As has been found in other studies, this analysis concluded that most college students are not meeting the recommendations for fruit and vegetable intake (American College Health Association, 2018). Findings were consistent with previous studies in that females reported higher consumption of fruits and vegetables than males (Boek et al., 2012; Despande et al., 2009; Li et al., 2012). Although previous studies have found that influencing factors for intake change over time spent at a university, in this analysis there was no significant correlation between age or status in school and reported intake of fruits and vegetables (Driskell et al., 2005; Vilaro et al., 2018). This implies that although students report that they can be influenced to make different food choices, either the influence is not occurring for fruits and vegetable intake, or the purported influencing factors are not as strong as students perceive them to be.

The confirmation of inadequate fruit and vegetable intake among the college student population provided by this study is especially important in the light of evidence for reduced GPAs, test scores, and attendance associated with low fruit and vegetable intake (Burrows et al., 2017; Deliens et al., 2013). Since the evidence supports that different subsets of this population perceive themselves as being influenced by different factors and this study found that intake of fruits and vegetables is lower than recommendations across demographics, diverse health promotion tactics are most likely to be effective in improving dietary intake (Boek et al., 2012; Deshpande et al., 2009). Health promotion should include education on not only improving flavors and reducing the cost of eating fruits and vegetables, but also demonstrating that peers are consuming fruits and vegetables and that it can result in improved health outcomes. A variety

of methods for promoting fruit and vegetable intake is needed to improve dietary behaviors of this population.

This study also contributes a partial answer to which aspects college students are taking into account when they evaluate their own health status. Health, particularly as addressed by the survey question used in this analysis, is subjective. When thinking of health, some students may only think of physical aspects while others are evaluating mental and emotional health as well. Students who report better perceived health are more likely to eat at least three servings of fruits and vegetables per day. Additional research is needed to determine whether students believe that fruits and vegetables are beneficial for health and whether students who report better health are more likely to have access to and consume fruits and vegetables.

Limitations

This study utilized ACHA-NCHA survey data from one public, Midwestern university which may be generalized to other public, Midwestern universities, but should not be generalized to other universities around the nation. The demographic profile of the survey respondents was similar to university demographics from the same year, although respondents who identified as white and/or female were over-represented in the sample.

The ACHA-NCHA survey was not designed to collect specific nutrition information but rather to provide a very broad idea of what students are eating. While it was appropriate for this level of study, more inclusive and specific dietary data could provide a better picture of what dietary patterns and behaviors are correlated with health perception. The university did provide additional questions with their survey, but the questions were not validated and as such do not

have the necessary reliability for in depth research. Validation of these questions or use of already validated questions with this survey in the future would increase their strength for future studies of this population.

In addition, survey data as a marker of dietary intake can be less accurate than other forms of tracking and, due to misunderstanding of portion sizes and foods groups, intake may be misreported or misrepresented in survey answers. This survey is self-administered and there is no identifiable data collected so students may not feel that it is necessary to be honest or accurate in their responses. The survey is cross-sectional, use of a longitudinal study and following the same group of students through their time at university may yield different results.

Future Research

This study evaluated reported fruit and vegetable intake by university students as determined by previously identified influencing factors. Future research could elaborate on the relationship of fruit and vegetable intake and health perception. Whether fruit and vegetable intake leads to improved health perception or if a change in health perception leads to a change in fruit and vegetable intake. In addition, evaluation of accuracy of reported intake to actual intake in this population is lacking in the literature. Finally, an evaluation of which factors, if any, lead to changes in perceived level of health and whether this is linked to changes in actual health markers.

A future study utilizing data from this university could validate the already existing supplemental institution questions or write new ones to better capture information regarding student intake behaviors. Fruit and vegetable intake could be separated as the literature supports

associations with outcomes for fruit and vegetable intake independent of one another. Since this data set is available from more than one university, it would also be possible to extend this study to include all universities that participate in the NCHA to provide a more well-rounded view of university students from around the nation, offering both a more diverse and larger sample of the college population to validate these study results.

Conclusion

This study aimed to identify whether previously recognized influencing factors were associated with actual differences in reported intake. Gender and perceived level of health are associated with differences in fruit and vegetable intake which is consistent with previous findings that these factors influence food related behaviors. Consider gender when studying the relationships between fruit and vegetable intake and health in college students. More needs to be understood about whether students believe fruit and vegetable intake leads to better health or whether better health allows them to consume more fruits and vegetables. This study indicates more can be done to improve fruit and vegetable intake among college students and this may contribute to better perceived health. Health promotion programs on campus are a common approach to address this problem. Prospective research in a diverse college population is needed to better understand this problem, as well as effectiveness of health promotion efforts on campuses.

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APPENDIX. SURVEY QUESTIONS INCLUDED IN ANALYSIS

How would you describe your general health?
[ ] Excellent
[ ] Very good
[ ] Good
[ ] Fair
[ ] Poor
[ ] Don't know

How many servings of fruits and vegetables do you usually have per day? (1 serving = 1 medium piece of fruit; ½ cup fresh, frozen, or canned fruits/vegetables; ¾ cup fruit/vegetable juice; 1 cup salad greens; or ½ cup dried fruit)
[ ] 0 servings per day
[ ] 1-2 servings per day
[ ] 3-4 servings per day
[ ] 5 or more servings per day

How old are you?
_____ Years

What sex were you assigned at birth, such as on an original birth certificate?
[ ] Female
[ ] Male

What is your year in school?
[ ] 1st year undergraduate
[ ] 2nd year undergraduate
[ ] 3rd year undergraduate
[ ] 4th year undergraduate
[ ] 5th year or more undergraduate
[ ] Graduate or professional
[ ] Not seeking a degree
[ ] Other

What is your enrollment status?
[ ] Full-time
[ ] Part-time
[ ] Other

How do you usually describe yourself? (Mark all that apply)
[ ] White
[ ] Black
[ ] Hispanic or Latino/a
[ ] Asian or Pacific Islander
[ ] American Indian, American Native, or Native Hawaiian
[ ] Biracial or Multiracial
[ ] Other

Are you an international student?
[ ] No
[ ] Yes

Where do you currently live?
[ ] Campus residence hall
[ ] Fraternity or sorority house
[ ] Other college/university housing
[ ] Parent/guardian's home
[ ] Other off-campus housing
[ ] Other

A complete listing of ACHA-NCHA survey questions can be found at:

American College Health Association. *ACHA-NCHA IIc* (Fall 2015-Spring 2019). (2020). https://www.acha.org/documents/ncha/ACHA-NCHA_IIc_Web_Survey_2011_SAMPLE.pdf.